

**OPEN FRAME DC POWER SUPPLY**



**COMPONENT POWER MODULE  
FOR  
N+1 DC POWER SYSTEM**

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**MODEL: SEC-1024MPSB**



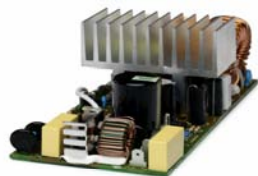
Thank you for purchasing a Samlex power supply  
product!

Samlex America Inc.  
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Coquitlam, BC V3K 6V2 Canada  
Toll-Free 1-800-561-5885

SEC-1024MPSB\_June2005

**INSTALLATION & OPERATING MANUAL**

Please read this manual before operating your power supply.



- PROVIDES N+1 REDUNDANCY (2 OR MORE RUNNING IN PARALLEL)
- EXPAND OUTPUT POWER BY ADDING POWER MODULES
- OPERATION STATUS L.E.D.
- REMOTE INDICATION OF OPERATION STATUS
- OPEN FRAME CONSTRUCTION
- 2 YEAR WARRANTY
- TOLL FREE TECHNICAL SUPPORT

**Notes :**

Attach your original bill of sale here.

Date purchased : \_\_\_\_\_

Place of purchase : \_\_\_\_\_

Purchase price : \_\_\_\_\_

Serial number : \_\_\_\_\_

## **2 YEAR Limited Warranty**

This product manufactured by Samlex America, Inc. (the "Warrantor") is warranted to be free from defects in workmanship and materials under normal use and service. This warranty is in effect for 2 years from the date of purchase by the user (the "Purchaser")

If the defective product is within the warranty period, the Purchaser should contact the place of purchase to obtain a Return Authorization Number.

The defective part or unit should be returned at the Purchaser's expense to the authorized location. A written statement describing the nature of the defect, the date of purchase, the place of purchase, and the Purchaser's name, address and telephone number should also be included.

If upon the Warrantor's examination, the defect proves to be the result of defective material or workmanship, the equipment will be repaired or replaced at the Warrantor's option without charge, and returned to the Purchaser at the Warrantor's expense if within the warranty period.

No refund of the purchase price will be granted to the Purchaser, unless the Warrantor is unable to remedy the defect after having a reasonable number of opportunities to do so.

Warranty service shall be performed only by the Warrantor. Any attempt to remedy the defect by anyone other than the Warrantor shall render this warranty void.

There shall be no warranty for defects or damages caused by faulty installation or hook-up, abuse or misuse of the equipment including exposure to excessive heat, salt or fresh water spray, or water immersion.

No other express warranty is hereby given and there are no warranties which extend beyond those described herein. This warranty is expressly in lieu of any other expressed or implied warranties, including any implied warranty of merchantability, fitness for the ordinary purposes for which such goods are used, or fitness for a particular purpose, or any other obligations on the part of the Warrantor or its employees and representatives.

There shall be no responsibility or liability whatsoever on the part of the Warrantor or its employees and representatives for injury to any persons, or damage to person or persons, or damage to property, or loss of income or profit, or any other consequential or resulting damage which may be claimed to have been incurred through the use or sale of the equipment, including any possible failure of malfunction of the equipment, or part thereof.

The Warrantor assumes no liability for incidental or consequential damages of any kind.

Samlex America Inc. (the "Warrantor")

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**IMPORTANT SAFETY INSTRUCTIONS**  
Please read before using your power supply.

**CAUTION!**

**ALL ELECTRICAL INSTALLATIONS MUST MEET LOCAL AND NATIONAL WIRING CODES AND SHOULD BE PERFORMED BY A QUALIFIED ELECTRICIAN.**

**COOLING:**

If the module is installed in an enclosed case, forced air cooling should be provided.

**AC INPUT:**

The power supply module should be operated from 120V AC/60 Hz source with proper earth ground connection.

120V, 60 Hz AC input is fed through quick disconnects marked "L" & "N". The pads under holes S1, S3 & S4 (Fig. 1 on page 4), should be connected to earth ground. Color code for AC input wires is:

	<u>NEMA</u>	<u>INTERNATIONAL</u>
QUICK DISCONNECT "L"	BLACK	BROWN
QUICK DISCONNECT "N"	WHITE	BLUE
PADS UNDER HOLES S1,S3,S4	GREEN	GREEN / YELLOW STRIPE

**SPECIFICATIONS**

INPUT VOLTAGE RANGE	105 to 125 V AC, 60Hz
OUTPUT VOLTAGE	(Pre-set) 28V DC
	Adjustment 26.8 to 28.5V DC
OUTPUT VOLTAGE REGULATION	1%
OUTPUT CURRENT	
CONTINUOUS	10A
SURGE	11.5A
OUTPUT CURRENT LIMIT	12A
OUTPUT RIPPLE	LESS THAN 150mV PEAK TO
PEAK	
OUTPUT NOISE	LESS THAN 2V PEAK TO PEAK
COOLING	THROUGH HEAT SINK MOUNTED ON THE PCB. REQUIRES FORCED AIR COOLING.
OPERATING TEMPERATURE	0 TO 40°C
PARALLEL OPERATION	YES, ACTIVE CURRENT SHARING
PROTECTIONS	
SHORT CIRCUIT	YES
CURRENT LIMIT	YES
INPUT SURGE SUPPRESSION	YES
FUSE	250V, 4A, SLOW-BLOW
DIMENSIONS	7.2" X 3.4" X 2.5"
WEIGHT, LBS	1.6

- b. Use additional appropriate DC radio frequency interference (RFI) power line filter immediately after the dc output of the power supply. **Recommended:** Corcom Inc.(www.cor.com ) "DA" / "DC" series
- c. Twist the positive and negative wires from the output of the power supply to the radio
- d. The DC side positive and negative outputs of these power supplies are isolated from the chassis. As explained at paragraph 5 above, the noise currents are filtered to the chassis ground and the chassis ground is connected to the earth ground through the earth ground pin of the AC power outlet receptacle. Avoid connecting (referencing) the DC negative output terminal of the power supply to the earth ground.
- e. Connect a 1/4" wave length of wire on the negative terminal of the power supply. Connect one end of the wire to the negative terminal and leave the other end free. The wave length corresponds to the wave length of the interfering frequency. (May not be practical for long wave lengths)

**[ Formula: Wave length (Meters) = 300 / frequency in MHz**

13.

#### **OUTPUT CONNECTION:**

28 VDC is supplied through pads under holes S5& S6. Always ensure that the positive and negative connections are secure and the screws are tightened properly. **Loosely tightened connections result in excessive voltage drop and may cause overheated wires and melted insulation.**

Use 14AWG wire to connect any device to the power supply module. This wire size is valid when the device is within 4 ft. distance from the power supply module. Thicker wiring will be required for longer distances.

**Thinner wires will cause overheating and excessive voltage drop.**

Ensure that the AC power is switched off when any device is being connected to the power supply module.

Do not allow the ends of the positive and negative wires to touch each other

#### **FUSE REPLACEMENT:**

Ensure that the fuse is a 250V, 4A slow blow

#### **ENVIRONMENT:**

Do not expose power supply module to rain, snow or water spray.

#### **DIS-ASSEMBLY AND REPAIR:**

The power supply module should be disassembled or repaired by a qualified technician. Incorrect reassembly or repair may result in a risk of electric shock or fire which may result in personal injury and property damage.

2.

#### **DESCRIPTION:**

This is a component power supply module for Samlex N+1 DC power system series SEC-24xxBRM (SEC-2430BRM, SEC-2440BRM, SEC-2450BRM) It converts 120V , 60 Hz AC into tightly regulated 28 VDC at 10A continuous. Two or more of these modules can be operated in parallel with active current sharing.

#### **APPLICATIONS:**

This unit is designed for the following applications:

- A) As a component power supply module (PSM) in Samlex N+1 DC Power System Series SEC-24xxBRM.
- B) Independent open frame power supply with active current sharing for parallel operation.

#### **DESIGN AND PRINCIPLE OF OPERATION:**

The power supply module is designed using advanced switch mode technology and load share circuitry for high reliability, high efficiency and minimum size and weight. Two or more power supply modules (referred to as PSM "POWER SUPPLY MODULES") can be connected for parallel operation with true current sharing. Each module is a stand alone power supply which delivers up to a maximum of 10A continuous (11.5A surge). By equalizing the output currents, (when 2 or more modules are operating in parallel), uniform thermal stress of the individual modules is ensured which has utmost importance for long term reliability of electronic components. The operating principle of the load share mechanism is to measure the output current of each individual module and to be able to modify the output voltage until all the participating modules deliver equal output currents. When connected in parallel, each module is required to be inter-connected with each other to a common "SHARE BUS" through a pair of parallel pins marked "JUMP1" and jumper wires. Typically, the output currents for the paralleled units will be within 10% of each other at full output current.

#### **COOLING:**

Heat generated in the module is dissipated through the heat sink mounted on the PCB.

When the module is being used as open frame power supply either singly or in parallel, forced air cooling is required to be provided to cool the heat sink.

#### **NOTE:**

**In some cases, to prevent electric shock hazard due to abnormal leakage current (like in marinas, spas, hot tubs, wet spaces etc.), the AC outlet circuits / receptacles in these areas are served through a GFCI ( Ground Fault Circuit Interrupter ).** This GFCI is normally set to trip when it senses an earth leakage current > 5 mA. A single GFCI may be serving multiple AC outlet circuits / receptacles and therefore, will be sensing the sum of all the leakage currents of the devices connected to these. As the switching power supplies have intentional leakage current as explained above, it may trip a GFCI feeding multiple AC outlet circuits / receptacles. In such cases, disconnect devices connected to the other AC outlet circuits / receptacles served by this GFCI

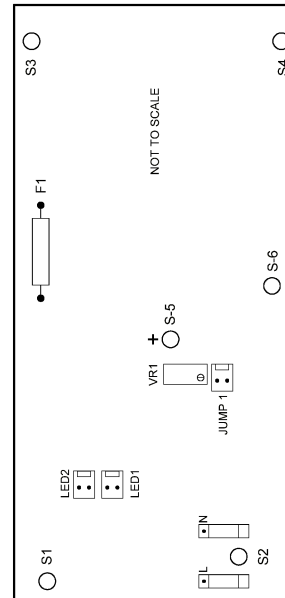
- 6. Following additional guidelines may be followed to reduce the effects of RF noise:
  - a. Use additional appropriate AC radio frequency interference (RFI) power line filter immediately before the ac input of the power supply. **Recommended:** Corcom Inc. ( [www.cor.com](http://www.cor.com) ) "Q" series. Filtered, ferrite coated cord set ( [www.emceupen.com](http://www.emceupen.com) ) is another choice. These cord sets, with integral line interference filters, reduce common and differential mode interferences over a wide frequency range. Because they are shielded, they are also effective against radiated interferences. In addition to the built-in filter networks, the cable conductors are coated with an RF absorbing ferrite compound. This provides additional attenuation at high frequencies that is lacking in most regular LC filters. The RF absorption of the ferrite-coated cable avoids resonance's at high frequencies, reducing the conducted and radiated RF noises even further

3. Switching power supplies are also recipients of radio interference. The normal operation of the power supply can be disturbed due to RF noise getting coupled into the power supply. Thus, the power supply may generate excessive RF noise and lose output voltage regulation due to excessive transmitter energy being coupled through the AC / DC lines to the power supply's regulator feedback path. This may be due to antenna being too close or due to the antenna or feed system not radiating properly. First check the antenna system SWR. Then, if necessary, relocate either the antenna or the power supply farther apart.
4. The receiver may "hear" the power supply. A slowly moving, slightly buzzing carrier heard in the receiver may be caused by the antenna being too close. As with the transmitter related noise pick up, a loose coaxial connector or a broken or a missing ground may aggravate this problem. Normally these noises will be below the background or "band" noise. Increase the separation between the power supply and the receiving antenna. Use an outdoor antenna. This will reduce the amount of signal picked up from the power supply and also increase the amount of the desired signal.
5. The conducted RF noise from these power supplies is limited to the maximum allowable levels by internal filtration. The filtered RF noise currents are bypassed to the chassis of the power supply. The chassis is, in turn connected to the earth ground pin of the AC input power cord (for Class 1 units). Thus, the filtered noise currents are intentionally leaked to the earth ground. This is termed as the "Earth Leakage Current". For safety against electric shock, this earth leakage current is also required to be limited. It will be seen that these two requirements are conflicting.

11.

#### **LAYOUT:**

Layout of the module is shown below



4.

**Figure 1—Layout of Power Supply Module**

- |                    |  |
|--------------------|--|
| <b>F1</b>          | <b>Fuse</b>  |
| <b>S1 to S4</b>    | Holes for 4 screws to fasten the module (Pads under holes S1, S3 & S4 should be connected to earth ground) |
| <b>S5 &amp; S6</b> | Pads under these holes provide + and - output connections.   |
| <b>L &amp; N</b>   | L (line) and N (neutral) terminals for 120V, 60 Hz input power supply wires                                |
| <b>LED1, LED2</b>  | Terminal for connecting green L.E.D.(s) for monitoring   |
| <b>JUMP 1</b>      | Jumper terminal for connecting share BUS wire  |
| <b>VR1</b>         | Potentiometer for output voltage control   |

### **CONTROLS AND MONITORING:**

**OUTPUT VOLTAGE CONTROL:** Potentiometer VR1 is a multi-turn potentiometer for fine adjustment of the output voltage. It is preset at 28V. It can adjust the output voltage from 26.8 to 28.5V

**LED FOR MONITORING STATUS OF OPERATION:** LED 1/ LED2 provide connection for LED for monitoring the status of operation. In the Samlex N+1 DC Power System series SEC-24XXBRM, one green L.E.D. is taken to the front panel indication "PSM Status". The second LED connector is for remote monitoring.

### **PROTECTIONS:**

**SHORT CIRCUIT PROTECTION:** In the event of a short circuit, the PWM controller will be shut down and the output will dip to near 0V. The green LED(s) connected to LED1/LED2 will flash. The unit will reset automatically once the short circuit condition is removed.

**CURRENT LIMITING:** The module will enter this mode when the load tries to draw more than the limiting value of 11.5A. Under this condition, there will be loss of voltage regulation and the output voltage will drop. The green LED(s) connected to LED1/LED2 will, however, remain illuminated, but dimmed. **The unit will reset automatically as soon as the overload condition is removed.**

**INPUT SURGE PROTECTION:** The module is protected against input voltage surges. ( By tripping the external AC side breaker ).

5.

### **NO OUTPUT VOLTAGE, GREEN LED(s) CONNECTED TO LED1/LED2 ARE FLASHING**

- There is a short circuit on the output side
- Switch off the unit. Disconnect the load from the output terminals. Switch on the unit. If the unit now operates normally, there is a short circuit in the external load circuit and should be removed .
- If short circuit condition persists even after removal of external load, switch off the unit and contact technical support.

### **WHEN TWO OR MORE UNITS ARE OPERATING IN PARALLEL**

- The output voltage of the individual modules is not the same or the forced share control circuitry of the module(s) is defective. Adjust the voltages of the module(s) to the same voltage. If the problem persists, call tech support.

### **LIMITING ELECTROMAGNETIC INTERFERENCE (EMI)**

1. Switched mode power supplies ( SMPS ) employ high frequency switching and thus, are a source of radio interference, a recipient of radio interference and a conduit of radio interference. ( Older linear type transformer based power supplies do not employ high frequency switching voltages and will be quieter as compared to switching type of supplies ).
2. The primary emission sources originate in the switching devices due to their fast switching current transitions: harmonics of the switching frequency and broadband noise created by under-damped oscillations in the switching circuit. The secondary source is from the bridge rectifier, both rectifier noise and diode recovery. The AC input rectifier / capacitor in the front end of the switching power supplies ( excepting those with power factor correction ) are notorious for generating power supply harmonics due to the non linear input current waveform. The noise is both conducted and radiated through the input power cord and the DC output wiring to the radio. Filters are used to limit the noise to acceptable level.



**TROUBLE SHOOTING**

**GREEN LED(S) CONNECTED TO LED 1/ LED 2 DOES NOT LIGHT UP**

- The module has become defective
- **WHEN TWO OR MORE UNITS ARE OPERATING IN PARALLEL**  
The associated module has become defective. The unit will still operate normally as the remaining working module(s) will share a higher load. The unit will go into current limit and the output voltage will drop if the load drawn is more than the combined maximum rated output of the remaining module(s). Reduce the load so that the maximum load drawn is less than the combined maximum rated output of the working module(s).

**OUTPUT VOLTAGE DROPS**

- The module has gone into current limit
- **WHEN TWO OR MORE UNITS ARE OPERATING IN PARALLEL**  
The unit has gone into current limit as the load being drawn is more than the combined maximum rating of the working module(s) This may also result if one or more modules has failed . Check that all the modules are operating properly. If a module has failed, its green LED, connected to LED1/LED2 would extinguish. Reduce the load drawn to a value less than the combined maximum rated output of the working module(s). If the voltage does not rise to the rated voltage of 28 V, then switch off all the loads. If the voltage in this condition is also low, switch off the unit and contact technical support

**INSTALLATION AND OPERATION** - AS COMPONENT PSM IN SAMLEX N+1 DC POWER SYSTEM SERIES SEC-24XXBRM

If the module is being installed in the Samlex N+1 DC Power System Series SEC-24XXBRM, read the instructions in the associated manual of the N+1 DC Power System.

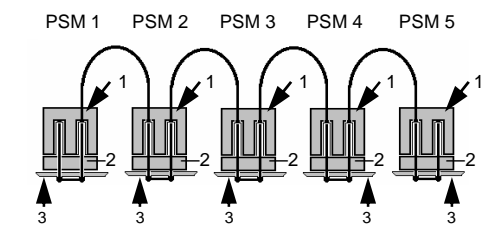
**INSTALLATION & OPERATION** - AS OPEN FRAME POWER SUPPLY

- Please refer to Fig. 1 on page 4.
- The AC input should be fed through a proper external switch and breaker based on rated current of each module at approx. 4A.
- Forced air cooling should be provided.
- Connect the AC input to quick disconnect terminals marked "L" (Line) & "N" (Neutral). Pads under holes S1,S3 & S4 should be connected to Earth Ground. Color code for wires is:

	<b><u>NEMA</u></b>	<b><u>INTERNATIONAL</u></b>
"L" (Line)	Black	Brown
"N" (Neutral)	White	Blue
Earth Ground	Green	Green with Yellow stripe

- The output is taken from the pads under holes S5(+) and S6(-).
- Operation status green L.E.D's are connected to connectors LED1/LED2 (Both the connectors are in parallel. One for local indication and the other for remote indication.)
- Switch on AC power, The green LED's connected to LED 1/ LED2 will light.
- Output voltage will read 28V. It can be adjusted between 26.8 & 28.5 V by potentiometer marked VR1. See page 4.
- Switch on the DC load. The green LED should remain lighted.

### **PARALLEL OPERATION** (Example: 5 Modules)



1. Female socket terminal of the daisy chain
2. Male 2 pin terminal marked "Jump 1" on the Power Supply Module.
3. PCB ( Printed Circuit Board )

Fig. 2 - Daisy chaining of share bus jumpers

Fig. 2 above shows an example of 5 modules connected in parallel to provide 50 Amps.

**CAUTION!** WHEN 2 OR MORE MODULES ARE OPERATED IN PARALLEL, THE OUTPUT VOLTAGE OF EACH MODULE SHOULD BE ADJUSTED TO THE SAME EXACT VALUE WITH THE HELP OF POTENTIOMETER VR1 ( See Figure 1 on page 4 )

- Adjust the output voltage of each module individually to the same output voltage.
- Feed AC input power to the 5 modules through a common switch and breaker rated for 20A ( 4A per module x 5 modules = 20A )
- Connect the positive and negative outputs of each module in parallel.
- Connect a 200 ohm 5W power resistor across the common output terminal to provide a static load. ( When units are operating in parallel, each unit requires a minimum load for the current share controller to work properly ).
- Inter-connect the share bus terminals marked Jump 1 as shown in Fig. 2 above.
- Switch on AC power to the modules. Ensure that green LED's connected to LED1/LED2 are lighted.
- Switch on the DC load. All the green LEDs connected to LED1/LED2 should remain lighted.